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# (54) Initializing optical multilayer recording

Initialisierende optische Mehrfachschichtaufzeichnung

Initialisation d'enregistrement optique sur support multicouche

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**EP-A- 0 768 652** **EP-A- 0 957 477**

- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 12, 25 December 1997 (1997-12-25) & JP 09 212918 A (HITACHI LTD;HITACHI MAXELL LTD), 15 August 1997 (1997-08-15)**

## Description

### BACKGROUND OF THE INVENTION

### Field of the Invention

**[0001]** The present invention relates to a multilayer optical recording medium having a plurality of recording layers and a recording method and apparatus of the multilayer optical recording medium.

### Description of the Related Art

**[0002]** In recent years, development of a multilayer optical disc has progressed as a recording medium having a large capacity wherein a recording capacity per side can be increased. The multilayer optical disc has a structure in which a plurality of half-mirror type reflection recording layers are laminated. For example, in a 2-layer DVD (Digital Versatile Disc) having two recording layers, two recording layers are stacked with a relatively small interval. A phase change recording film is formed on each of an upper layer (i.e., a layer near an optical pickup) and a lower layer. Upon recording of the 2-layer disc, a laser beam is focused on one of the recording layers and a data signal is recorded thereon.

**[0003]** It is, however, necessary to change recording conditions when recording is performed on the lower layer according to whether data has been recorded on the upper layer or no data is recorded thereon. This is because an average reflectance of the upper layer increases (i.e., an average transmittance decreases) when data has been recorded on the upper layer. There is, consequently, a problem that a recording density has to be set to a value lower than that used when recording data on a single-layer disc in consideration of a reduction of a S/N ratio (signal to noise ratio) due to an influence of larger average reflectance.

**[0004]** The problem becomes more serious for a multilayer optical disc in which the number of recording layers is further increased in order to increase the recording density. A large difference occurs in the transmittance or the S/N ratio in dependence on whether the recording layers over the recording layer on which recording is performed are recorded layers or not. There is, thus, a problem such that the necessity of sequentially recording data from the upper layer to the lower layer is caused or so many recording layers cannot be laminated.

**[0005]** Further, EP-A-0 957 477 discloses a multiplayer optical information recording medium having a large storage capacity, upon which the preamble of claim 1 is based. That conventional multilayer recording medium includes an upper recording layer having high transmittance and a lower recording layer for recoding data signals thereon, wherein the multiplayer recording medium is constructed such that for recording a data signal on the lower recording layer a light beam is transmitted through the upper recording layer and at the same time the light beam is irradiated to the lower recording layer.

**[0006]** Furthermore, there is known from EP-A-0 768 652 a multilayer optical disc having an upper phase change rewritable optical recording layer having a transmittance of 30 to 60 percent and a lower read-only recording layer. Prior to recording a data signal onto the upper recording layer the upper recording layer has to be initialized.

### OBJECTS AND SUMMARY OF THE INVENTION

**[0007]** The present invention is made in consideration of the foregoing problems and it is an object of the present invention to provide a multilayer optical recording medium on which a stable recording and reproducing can be performed. It is also an object of the present invention to provide a recording method and a recording apparatus of the multilayer optical recording medium.

**[0008]** To achieve this object, according to one aspect of the present invention, there is provided a method for recording data signals onto a multilayer recording medium having an upper recording layer and a lower recording layer including the features of claim 1. For recoding a data signal on the lower recording layer a light beam is transmitted through the upper recording layer and at the same time the light beam is irradiated to the lower recording layer, the upper and the lower recording layers being rewritable layers. The upper recording layer is initialized by recording a dummy signal thereon and thereby provided in an initialized state when recording the data signal on the lower recording layer, the dummy signal having a frequency (f) which satisfies

$$f \geq v \times n/(2 \times NA \times d),$$

where d is an interval between the upper recording layer and the lower recording layer, NA is the numerical aperture of an objective lens for converging the light beam, n is the refractive index of a medium between the upper and lower

recording layers, and v is the line velocity of the multilayer recording medium when recording the dummy signal.

**[0009]** According to a second aspect of the present invention, there is provided a recording apparatus for use with a multilayer recording medium including the features of claim 3.

**[0010]** According to a third aspect of the present invention, there is provided a recording method of a multilayer recording medium including the features of claim 6.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]**

Fig. 1 is a cross sectional view schematically showing a structure of a 2-layer recording disc along the tracking direction according to the present invention;
Fig. 2 is a block diagram showing a configuration of a recording apparatus of a multilayer optical disc according to the present invention;
Fig. 3 is a flowchart showing a procedure for initializing a 2-layer optical disc according to the first embodiment of the present invention; and
Fig. 4 is a diagram showing a laser beam and a beam spot on a recording layer when using a recording apparatus of a multilayer recording disc according to the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0012]** Embodiments of the present invention will be described in detail with reference to the drawings.

First embodiment

**[0013]** Fig. 1 is a cross sectional view in the tracking or tracing direction schematically showing a structure of a 2-layer recording disc according to the present invention. A 2-layer recording disc 10 is sequentially constructed by a cover layer 11, a phase change recording film 12 of an upper layer, a guide groove 13 constructing an information recording track of the upper layer, a spacer layer 14, a phase change recording film 15 of a lower layer, a guide groove 16 of the lower layer, and a disc substrate 17 in order from the irradiating side of a light beam for recording or reproducing information data.

**[0014]** A material having a high optical transmittance in a wavelength band of the irradiation light is used for the cover layer 11 and spacer layer 14, for example, an ultraviolet hardening resin material or the like, since the irradiation light passes through the layers 11, 14. Germanium antimonytellurium (GeSbTe) or the like is used as a material of the phase change recording films 12 and 15. A material such as polycarbonate or the like is used for the disc substrate.

**[0015]** The phase change recording films 12 and 15 are in an amorphous state where the reflectance is low and transmittance is high when the films are formed. The temperature of a portion where a laser beam is irradiated rises when recording is performed by irradiating the laser beam from an optical pickup. After the temperature exceeds a crystallization temperature, the laser beam irradiated portion is cooled, so that the portion changes into a crystal state where the reflectance is high and transmittance is low. Among the materials for the film, there is a material such that recording cannot be performed unless the material is initialized into a stable amorphous state by irradiation of light, or there is also a material on which recording can be performed without the initialization, i.e., on the material as it is formed. Any of those materials, however, can be used. A description will be made wherein the material on which recording can be performed without the initialization is used for the phase change recording film.

**[0016]** In the following description, an upper recording layer 18 (i.e., the first layer when it is seen from the irradiating side of the light beam) including the phase change recording film 12 and guide groove 13 is referred to as a layer-0 (L0), and a lower recording layer 19 (i.e., the second layer) including the phase change recording film 15 and guide groove 16 is referred to as a layer-1 (L1). By moving the focal position of the irradiated light beam in the depth direction, an information data signal can be recorded to any one of the recording layers of the layer-0 (L0) 18 and the layer-1 (L1) 19 and the information data signal can be reproduced from any one of the recording layers.

**[0017]** Fig. 2 is a block diagram showing a configuration of a recording apparatus 20 of a multilayer optical disc according to the present invention. The data signal is recorded on the optical disc 10 having the phase change recording films of two layers by an irradiation laser beam emitted from an optical pickup 21.

**[0018]** The optical pickup 21 includes: a light source 22 for emitting a laser beam; a collimator lens 23 for converting the emitted laser beam into a parallel laser beam; and an objective lens 24 for converging the collimated laser beam. A tracking position and an irradiation laser beam focal position of the optical pickup 21 are changed in accordance with a driving signal from a driver 28 which operates on the basis of a control signal from a controller 27. The optical disc 10 is rotated by a spindle motor 29. The spindle motor 29 operates on the basis of a control signal from the controller 27.

**[0019]** The optical pickup 21 is further connected to an initialization-signal generating circuit 33 and a data-signal generating circuit 34 via a switching circuit 31. The controller 27 controls the switching circuit 31 on the basis of an input control signal from an operation panel 36 operated by a user or a read signal from a photodetector (not shown) in the optical pickup 21, for example, TOC (Table of Contents) information or the like, thereby selectively supplying one of an initialization signal and a data signal, which will be explained hereinlater, to the optical pickup 21. As mentioned above, the controller 27 simultaneously controls the driver 28, thereby allowing the selected signal to be recorded on one of the recording layers of the optical disc 10.

**[0020]** The data-signal generating circuit 34 converts each of various digital data such as image, audio data, information data, and the like into a signal of a predetermined format adapted to the recording of the optical disc 10, thereby generating a recording data signal (hereinafter, simply referred to as a data signal). The data-signal generating circuit 34 may also be connected to a signal processing circuit for generating the various digital data, a receiving circuit, a storing circuit (not shown) in which various digital data has been stored, and the like and may convert the digital data supplied from the circuits into recording data signals.

**[0021]** The initialization-signal generating circuit 33 generates the initialization signal which is recorded into a recording layer of the optical disc 10 in order to initialize the recording layer. As an initialization signal, a non-modulation or unmodulated signal of a predetermined current value or a dummy signal can be used. A process for initializing the optical disc 10 will now be described hereinbelow.

**[0022]** Fig. 3 is a flowchart showing a procedure for initializing the optical disc 10 which is performed by the controller 27. It is determined whether a loaded optical disc 10 is an initialized disc or not (step S11). This determination can be made, for example, on the basis of data (or a flag or the like) recorded in a data region which is provided in a lead-in area of the optical disc 10 and indicates whether the disc has been initialized or not, or can be made on the basis of a signal inputted by the user operation of the operation panel 36.

**[0023]** If it is determined that the optical disc 10 is not initialized, the controller 27 allows the non-modulation signal from the initialization-signal generating circuit 33 to be supplied to the optical pickup 21 and drives the laser light source 22 with the predetermined current, thereby initializes the layer-1 (L1) 19 of the optical disc 10 (step S12). The initializing method is generally similar to that of the recording layer used hitherto. If it is determined in step S11 that the disc has been initialized, control exit the routine to return to the main routine.

**[0024]** Subsequently, the layer-1 (L0) 18 is initialized. In this instance, the controller 27 calculates a modulation frequency (f) of the dummy signal and a driving current value (or a duty ratio) of the laser light source 22 (step S13) in order to initialize the layer-0 (L0) 18. The modulation frequency (f) of the dummy signal is determined such that more than one period of the signal is included within the beam diameter on the layer-0 (L0) 18 when the laser beam is focused on the layer-1 (L1) 19 while transmitting through the layer-0 (L0) 18. The objective lens 24 is set to have a predetermined numerical aperture for recording or reproduction. More specifically, the modulation frequency (f) is set as follows:

$$f \geq v \times n/(2 \times NA \times d) \quad \ldots (1)$$

where,

| | |
|---|---|
| d (mm): | interval between the layer-0 (L0) 18 and the layer-1 (L1) 19 |
| NA: | numerical aperture of the objective lens 24 |
| NA: | refractive index of a medium between the layers |
| v (mm/sec): | line velocity at the time of initialization |

At this time, the driving current value (or duty ratio) is selected to a value so that the light transmittance of the layer-0 (L0) 18 after the initialization is approximately or substantially equal to that after the predetermined data signal was recorded on the layer-0 (L0) 18. A data signal corresponding to a feature of the data signal to be recorded (for example, image data, audio data, information data which is used in a computer, etc.) can be used or a predetermined data signal irrespective of the feature of the data signal can be used. Although the description is made wherein the output signals of the initialization-signal generating circuit 33 and data-signal generating circuit 34 are switched by using the switching circuit 31, the present invention is not limited to the configuration. The data-signal generating circuit 34 may generate an initialization data signal as well as a recording data signal.

**[0025]** The modulation frequency (f) actually has an upper limit frequency (fc) which is determined by a cut-off frequency of the initialization-signal generating circuit 33 or a light density necessary for recording one pulse of the signal. More specifically, the modulation frequency (f) is also set so as to satisfy the following expression.

$$fc \geq f \qquad \ldots (2)$$

**[0026]** The controller 27 controls the switching circuit 31 so as to supply a dummy pulse signal which has been determined by the above method from the initialization-signal generating circuit 33 to the optical pickup 21 to record the dummy pulse signal, thereby initializing the layer-0 (L0) 18 (step S14).

**[0027]** Subsequently, data (or flag or the like) indicating that the disc has already been initialized is recorded into a predetermined data region on the optical disc 10 (step S15). The processing routine is finished.

**[0028]** According to the above-mentioned processing procedure, the initialized recording layer has approximately the same transmittance as that of the recording layer on which the data signal has been recorded. Upon recording or reproduction of the layer-1 (L1) 19, therefore, a stable recording or reproduction in which the intensity of the laser beam does not fluctuate can be performed since the transmittance of the layer-0 (L0) 18 does not substantially change irrespective of whether the data signal has been recorded on the layer-0 (L0) 18 (i.e., an upper layer) or not.

**[0029]** The order in the foregoing processing routine can be modified so as to execute the initialization of the layer-0 (L0) 18 with the dummy signal (step S14) before the initialization of the layer-1 (L1) 19 with the non-modulation signal (step S12). It is sufficient that the calculation (step S13) of the modulation frequency (f) of the dummy signal and the driving current value (or duty ratio) of the laser light source 22 is executed prior to the initialization of the layer-0 (L0) 18 with the dummy signal. For example, the values may be previously calculated before the start of the initializing routine.

Second embodiment

**[0030]** Recording apparatus and method of a multilayer recording disc according to the second embodiment of the present invention will now be described hereinbelow with reference to Fig. 4.

**[0031]** In the embodiment, the optical pickup 21 has an optical system (not shown) for emitting an elliptic laser beam 41. More particularly, a beam spot 43 which is formed by irradiating the laser beam 41 on the recording layer has an elliptic shape whose major axis is in the direction that is approximately perpendicular to tracks of the multilayer recording disc 10 and which is located over a plurality of tracks of the multilayer recording disc 10. A plurality of tracks 45, therefore, can be simultaneously initialized by the laser beam 41. A time that is required for the initialization can be remarkably reduced by using an elliptic shape laser beam.

**[0032]** Although the example of the 2-layer optical disc has been described in the above embodiment, the present invention can be also similarly applied to an optical disc having a plurality of phase change recording films.

**[0033]** The initialization by the dummy signal or the non-modulation signal does not need to be performed over the whole surface of the optical disc but may be executed with respect to only a part of the disc.

**[0034]** As dummy information for generating the dummy signal, information which does not have any meaning by itself, for example, random data or a pulse train of a predetermined period can be used. For an image/audio data, a picture of a monochromatic color, audio data of a predetermined frequency, or the like can be used. When a dummy data having a meaning by itself is used, the data should be obviously distinguished from information data to be recorded, for example, an image or audio data which indicates that the data is dummy.

**[0035]** As will be obviously understood from the above description, according to the present invention, there is provide a multilayer optical recording medium on which stable recording can be performed and a recording method and an apparatus of the multilayer optical recording medium.

**[0036]** The invention has been described with reference to the preferred embodiments thereof. It should be understood by those skilled in the art that a variety of alterations and modifications may be made from the embodiments described above. It is therefore contemplated that the appended claims encompass all such alterations and modifications.

## Claims

1. A method for recording data signals onto a multilayer recording medium (10) having an upper recording layer (18) and a lower recording layer (19), wherein for recording a data signal on said lower recording layer (19) a light beam is transmitted through said upper recording layer (18) and at the same time said light beam is irradiated to said lower recording layer (19), said upper recording layer (18) and said lower recording layer (19) being rewritable layers,
   **characterized in that**
   said upper recording layer (18) is initialized by recording a dummy signal thereon and thereby provided in an initialiszed state when recording the data signal on said lower recording layer (19), said dummy signal having a frequency (f) which satisfies:

$$f \geq v \times n/(2 \times NA \times d)$$

where

d (mm): interval between said upper recording layer and said lower recording layer,
NA: numerical aperture of an objective lens for converging said light beam,
n: refractive index of a medium between said upper recording layer and said lower recording layer,
v (mm/sec) : line velocity of said multilayer recording medium when recording said dummy signal.

**2.** A method according to claim 1, wherein said dummy signal has a pulse train such that a transmittance of said upper recording layer (18) after said dummy signal is recorded is approximately identical to a transmittance after a predetermined data signal is recorded to said upper recording layer.

**3.** A recording apparatus (20) for use with a multilayer recording medium (10) having an upper recording layer (18) and a lower recording layer (19) for recording data signals thereon, said upper recording layer (18) and said lower recording layer (19) being rewritable layers, the interval between said upper recording layer (18) and said lower recording layer (19) being d (mm) and the refractive index of a medium between said upper recording layer (18) and said lower recording layer (19) being n, wherein said multilayer recording medium is constructed such that for recording a data signal on said lower recording layer (19) a light beam is transmitted through said upper recording layer (18) and at the same time said light beam is irradiated to said lower recording layer (19), comprising:

a recording unit for recording a dummy signal on said upper recording layer (18) and
thereby providing it in an initialized state when recording the data signal on said lower recording layer (19),

**characterized in that**
said recording unit includes a dummy-signal generating unit (33) for generating said dummy signal, said dummy signal having a frequency (f) which satisfies:

$$f \geq v \times n/(2 \times NA \times d)$$

where

d (mm) : interval between said upper recording layer and said lower recording layer,
NA: numerical aperture of an objective lens for converging said light beam,
n: refractive index of said medium between said upper recording layer and said lower recording layer,
v (mm/sec): line velocity of said multilayer recording medium when recording said dummy signal.

**4.** An apparatus according to claim 3, wherein said dummy signal has a pulse train such that a transmittance of said upper recording layer (18) after said dummy signal is recorded is approximately identical to a transmittance after a predetermined data signal is recorded to said upper recording layer.

**5.** An apparatus according to claim 3 or 4, wherein said light beam has an elliptic beam spot whose major axis is located in a direction that is approximately perpendicular to tracks on said multilayer recording medium (10) and said beam spot is located over a plurality of tracks of said multiplayer recording medium.

**6.** A recording method of a multilayer recording medium (10) having an upper recording layer (18) and a lower recording layer (19) for recording data signals thereon, said upper recording layer (18) and said lower recording layer (19) being rewritable layers, the interval between said upper recording layer (18) and said lower recording layer (19) being d (mm) and the refractive index of a medium between said upper recording layer (18) and said lower recording layer (19) being n, wherein said multilayer recording medium is constructed such that for recording a data signal on said lower recording layer (19) a light beam is transmitted through said upper recording layer (18) and at the same time said light beam is irradiated to said lower recording layer (19), comprising:

a first initializing step (S12) of initializing said lower recording layer (19) by recording a non-modulation signal

thereon based on a first initializing condition; and
a second initializing step (S14) of initializing said upper recording layer (18) by recording a dummy signal thereon based on a second initializing condition and
thereby providing it in an initialized state when recording the data signal on said lower recording layer (19),

wherein said second initializing condition is determined so that a transmittance of said upper recording layer (18) after execution of said second initializing step (S14) is approximately equal to a transmittance of said upper recording layer after a predetermined data signal is recorded on said upper recording layer,
**characterized in that**
said dummy signal has a frequency (f) which satisfies:

$$f \geq v \times n/(2 \times NA \times d)$$

where

d (mm): interval between said upper recording layer and said lower recording layer,
NA: numerical aperture of an objective lens for converging said light beam,
n: refractive index of said medium between said upper recording layer and said lower recording layer,
v (mm/sec): line velocity of said multilayer recording medium when recording said dummy signal.

## Patentansprüche

1. Verfahren zum Aufzeichnen von Datensignalen auf ein mehrlagiges Aufzeichnungsmedium (10) mit einer oberen Aufzeichnungsschicht (18) und einer unteren Aufzeichnungsschicht (19), wobei zum Aufzeichnen eines Datensignals auf der unteren Aufzeichnungsschicht (19) ein Lichtstrahl durch die obere Aufzeichnungsschicht (18) übertragen wird und gleichzeitig der Lichtstrahl auf die untere Aufzeichnungsschicht (19) gerichtet wird, wobei die obere Aufzeichnungsschicht (18) und die untere Aufzeichnungsschicht (19) überschreibbare Schichten sind,
**dadurch gekennzeichnet,**
**dass** die obere Schicht (18) durch Aufzeichnen eines Dummy-Signals darauf vorformatiert wird und **dadurch** beim Aufzeichnen des Datensignals auf der unteren Aufzeichnungsschicht (19) in einem vorformatierten Zustand vorgesehen ist, wobei das Dummy-Signal eine Frequenz (f) besitzt, die dem Ausdruck genügt:

$$f \geq v \times n / (2 \times NA \times d)$$

mit

d (mm): Abstand zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
NA: numerische Apertur einer Objektivlinse zum Bündeln des Lichtstrahls,
n: Brechungsindex eines Mediums zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
v (mm/sec): Liniengeschwindigkeit des mehrlagigen Aufzeichnungsmediums beim Aufzeichnen des Dummy-Signals.

2. Verfahren nach Anspruch 1, bei welchem das Dummy-Signal eine solche Pulsfolge besitzt, dass ein Durchlässigkeitsgrad der oberen Aufzeichnungsschicht (18), nachdem das Dummy-Signal aufgezeichnet ist, etwa identisch zu einem Durchlässigkeitsgrad ist, nachdem ein vorbestimmtes Datensignal auf der oberen Aufzeichnungsschicht aufgezeichnet ist.

3. Aufzeichnungsvorrichtung (20) zur Verwendung mit einem mehrlagigen Aufzeichnungsmedium (10) mit einer oberen Aufzeichnungsschicht (18) und einer unteren Aufzeichnungsschicht (19) zum Aufzeichnen von Datensignalen darauf, wobei die obere Aufzeichnungsschicht (18) und die untere Aufzeichnungsschicht (19) überschreibbare Schichten sind, der Abstand zwischen der oberen Aufzeichnungsschicht (18) und der unteren Aufzeichnungsschicht (19) d (mm) und der Brechungsindex eines Mediums zwischen der oberen Aufzeichnungsschicht (18) und der unteren

Aufzeichnungsschicht (19) n ist,
wobei das mehrlagige Aufzeichnungsmedium so aufgebaut ist, dass zum Aufzeichnen eines Datensignals auf der unteren Aufzeichnungsschicht (19) ein Lichtstrahl durch die obere Aufzeichnungsschicht 18 übertragen wird und gleichzeitig der Lichtstrahl auf die untere Aufzeichnungsschicht (19) gerichtet wird, mit
einer Aufzeichnungseinheit zum Aufzeichnen eines Dummy-Signals auf der oberen Aufzeichnungsschicht (18) und **dadurch** Bereitstellen von ihr in einem vorformatierten Zustand beim Aufzeichnen des Datensignals auf der unteren Aufzeichnungsschicht (19),
**dadurch gekennzeichnet,**
**dass** die Aufzeichnungseinheit eine Dummy-Signal-Erzeugungseinheit (33) zum Erzeugen des Dummy-Signals enthält, wobei das Dummy-Signal eine Frequenz (f) besitzt, die dem Ausdruck genügt:

$$f \geq v \times n / (2 \times NA \times d)$$

mit

d (mm): Abstand zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
NA: numerische Apertur einer Objektivlinse zum Bündeln des Lichtstrahls,
n: Brechungsindex eines Mediums zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
v (mm/sec): Liniengeschwindigkeit des mehrlagigen Aufzeichnungsmediums beim Aufzeichnen des Dummy-Signals.

**4.** Vorrichtung nach Anspruch 3, bei welchem das Dummy-Signal eine solche Pulsfolge aufweist, dass ein Durchlässigkeitsgrad der oberen Aufzeichnungsschicht (18), nachdem das Dummy-Signal aufgezeichnet ist, etwa identisch zu einem Durchlässigkeitsgrad ist, nachdem ein vorbestimmtes Datensignal auf der oberen Aufzeichnungsschicht aufgezeichnet ist.

**5.** Vorrichtung nach Anspruch 3 oder 4, bei welcher der Lichtstrahl einen elliptischen Strahlfleck besitzt, dessen Hauptachse in einer Richtung angeordnet ist, die etwa senkrecht zu Spuren auf dem mehrlagigen Aufzeichnungsmedium (10) ist, wobei der Lichtfleck über mehrere Spuren des mehrlagigen Aufzeichnungsmediums positioniert ist.

**6.** Aufzeichnungsverfahren eines mehrlagigen Aufzeichnungsmediums (10) mit einer oberen Aufzeichnungsschicht (18) und einer unteren Aufzeichnungsschicht (19) zum Aufzeichnen von Datensignalen darauf, wobei die obere Aufzeichnungsschicht (18) und die untere Aufzeichnungsschicht (19) überschreibbare Schichten sind, wobei der Abstand zwischen der oberen Aufzeichnungsschicht (18) und der unteren Aufzeichnungsschicht (19) d (mm) und der Brechungsindex eines Mediums zwischen der oberen Aufzeichnungsschicht (18) und der unteren Aufzeichnungsschicht (19) n ist, wobei das mehrlagige Aufzeichnungsmedium so aufgebaut ist, dass zum Aufzeichnen eines Datensignals auf der unteren Aufzeichnungsschicht (19) ein Lichtstrahl durch die obere Aufzeichnungsschicht (18) übertragen wird und gleichzeitig der Lichtstrahl auf die untere Aufzeichnungsschicht (19) gerichtet wird, mit einem ersten Vorformatierungsschritt (S12) des Vorformatierens der unteren Aufzeichnungsschicht (19) durch Aufzeichnen eines Nichtmodulationssignals darauf basierend auf einem ersten Vorformatierungszustand; und einem zweiten Vorformatierungsschritt (S14) des Vorformatierens der oberen Aufzeichnungsschicht (18) durch Aufzeichnen eines Dummy-Signals darauf, basierend auf einem zweiten Vorformatierungszustand und **dadurch** Bereitstellens von ihr in einem vorformatierten Zustand beim Aufzeichnen des Datensignals auf der unteren Aufzeichnungsschicht (19), wobei der zweite Vorformatierungszustand so bestimmt wird, dass ein Durchlässigkeitsgrad der oberen Aufzeichnungsschicht (18) nach der Ausführung des zweiten Vorformatierungsschritts (S14) etwa gleich einem Durchlässigkeitsgrad der oberen Aufzeichnungsschicht ist, nachdem ein vorbestimmtes Datensignal auf der oberen Aufzeichnungsschicht aufgezeichnet ist,
**dadurch gekennzeichnet,**
**dass** das Dummy-Signal eine Frequenz (f) besitzt, die dem Ausdruck genügt:

$$f \geq v \times n / (2 \times NA \times d)$$

mit

d (mm): Abstand zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
NA: numerische Apertur einer Objektivlinse zum Bündeln des Lichtstrahls,
n: Brechungsindex eines Mediums zwischen der oberen Aufzeichnungsschicht und der unteren Aufzeichnungsschicht,
v (mm/sec): Liniengeschwindigkeit des mehrlagigen Aufzeichnungsmediums beim Aufzeichnen des Dummy-Signals.

## Revendications

1. Procédé pour enregistrer des signaux de données sur un support d'enregistrement multicouche (10) ayant une couche d'enregistrement supérieure (18) et une couche d'enregistrement inférieure (19), dans lesquelles pour enregistrer un signal de données sur ladite couche d'enregistrement inférieure (19), un faisceau est transmis à travers ladite couche d'enregistrement supérieure (18) et en même temps ledit faisceau de lumière est irradié sur ladite couche d'enregistrement inférieure (19), ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant des couches réinscriptibles,
**caractérisé en ce que**
ladite couche d'enregistrement supérieure (18) est initialisée par l'enregistrement d'un signal fictif sur celle-ci et fournie ainsi dans un état initialisé lors de l'enregistrement du signal de données sur ladite couche d'enregistrement inférieure (19), ledit signal fictif ayant une fréquence (f) qui satisfait :

$$f \geq v \times n/(2 \times NA \times d)$$

où

d (mm) : intervalle entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
NA : ouverture numérique d'une lentille d'objectif pour faire converger ledit faisceau de lumière,
n : indice de réfraction d'un support entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
v(mm/sec) : vélocité linéaire dudit support d'enregistrement multicouche lors de l'enregistrement dudit signal fictif.

2. Procédé selon la revendication 1, dans lequel, ledit signal fictif a un train d'impulsions tel qu'un facteur de transmission de ladite couche d'enregistrement supérieure (18) après que ledit signal fictif soit enregistré est approximativement identique à un facteur de transmission après qu'un signal de données prédéterminé soit enregistré sur ladite couche d'enregistrement supérieure.

3. Appareil d'enregistrement (20) destiné à être utilisé avec un support d'enregistrement multicouche (10) ayant une couche d'enregistrement supérieure (18) et une couche d'enregistrement inférieure (19) pour enregistrer des signaux sur celles-ci, ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant des couches réinscriptibles, l'intervalle entre ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant d(mm) et l'indice de réfraction d'un support entre ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant n, où ledit support d'enregistrement multicouche est construit de telle sorte que pour enregistrer un signal de données sur ladite couche d'enregistrement inférieure (19), un faisceau de lumière est transmis à travers ladite couche d'enregistrement supérieure (18) et en même temps ledit faisceau de lumière est irradié sur ladite couche d'enregistrement inférieure (19), comprenant : une unité d'enregistrement pour enregistrer un signal fictif sur ladite couche d'enregistrement supérieure (18) et ainsi le fournir dans un état initialisé lors de l'enregistrement du signal de données sur ladite couche d'enregistrement inférieure (19),
**caractérisé en ce que**
ladite unité d'enregistrement comprend une unité de génération de signal fictif (33) pour générer ledit signal fictif, ledit signal fictif ayant une fréquence (f) qui satisfait :

$$f \geq v \times n/(2 \times NA \times d)$$

où

d(mm) : intervalle entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
NA : ouverture numérique d'une lentille d'objectif pour faire converger ledit faisceau de lumière,
n : indice de réfraction d'un support entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
v(mm/sec) : vélocité linéaire dudit support d'enregistrement multicouche lors de l'enregistrement dudit signal fictif.

4. Appareil selon la revendication 3, dans lequel ledit signal fictif a un train d'impulsions tel qu'un facteur de transmission de ladite couche d'enregistrement supérieure (18) après que ledit signal fictif soit enregistré est approximativement identique à un facteur de transmission après qu'un signal de données prédéterminé soit enregistré sur ladite couche d'enregistrement supérieure.

5. Appareil selon la revendication 3 ou 4, dans lequel ledit faisceau de lumière a une tache de faisceau elliptique dont l'axe majeur est situé dans une direction qui est approximativement perpendiculaire aux pistes sur ledit support d'enregistrement multicouche (10) et ladite tache de faisceau est située sur une pluralité de pistes dudit support d'enregistrement multicouche.

6. Procédé d'enregistrement d'un support d'enregistrement multicouche (10) ayant une couche d'enregistrement supérieure (18) et une couche d'enregistrement inférieure (19) pour enregistrer des signaux de données sur celles-ci, ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant des couches réinscriptibles, l'intervalle entre ladite couche d'enregistrement supérieure (18) et ladite couche d'enregistrement inférieure (19) étant d(mm) et l'indice de réfraction d'un support entre ladite couche d'enregistrement supérieure (18) et ladite d'enregistrement inférieure (19) étant n, où ledit support d'enregistrement multicouche est construit de telle sorte que pour enregistrer un signal de données sur ladite couche d'enregistrement inférieure (19), un faisceau de lumière est transmis à travers ladite couche d'enregistrement supérieure (18) et en même temps ledit faisceau de lumière est irradié sur ladite couche d'enregistrement inférieure (19), comprenant : une première étape d'initialisation (S12) d'initialisation de ladite couche d'enregistrement inférieure (19) par l'enregistrement d'un signal de non-modulation sur celle-ci sur la base d'une première condition d'initialisation ; et
une seconde étape d'initialisation (S14) d'initialisation de ladite couche d'enregistrement supérieure (18) par l'enregistrement d'un signal fictif sur celle-ci sur la base d'une seconde condition d'initialisation et ainsi la fournir dans un état initialisé lors de l'enregistrement du signal de données sur ladite couche d'enregistrement inférieure (19),
dans lequel, ladite seconde condition d'initialisation est déterminée de telle sorte qu'un facteur de transmission de ladite couche d'enregistrement supérieure (18) après exécution de ladite seconde étape d'initialisation (S14) est approximativement égal à un facteur de transmission de ladite couche d'enregistrement supérieure après qu'un signal de données prédéterminé soit enregistré sur ladite couche d'enregistrement supérieure,
**caractérisé en ce que**
ledit signal fictif a une fréquence (f) qui satisfait :

$$f \geq v \times n/(2 \times NA \times d)$$

où

d(mm) : intervalle entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
NA : ouverture numérique d'une lentille d'objectif pour faire converger ledit faisceau de lumière,
n : indice de réfraction d'un support entre ladite couche d'enregistrement supérieure et ladite couche d'enregistrement inférieure,
v(mm/sec) : vélocité linéaire dudit support d'enregistrement multicouche lors de l'enregistrement dudit signal fictif.

FIG. 1

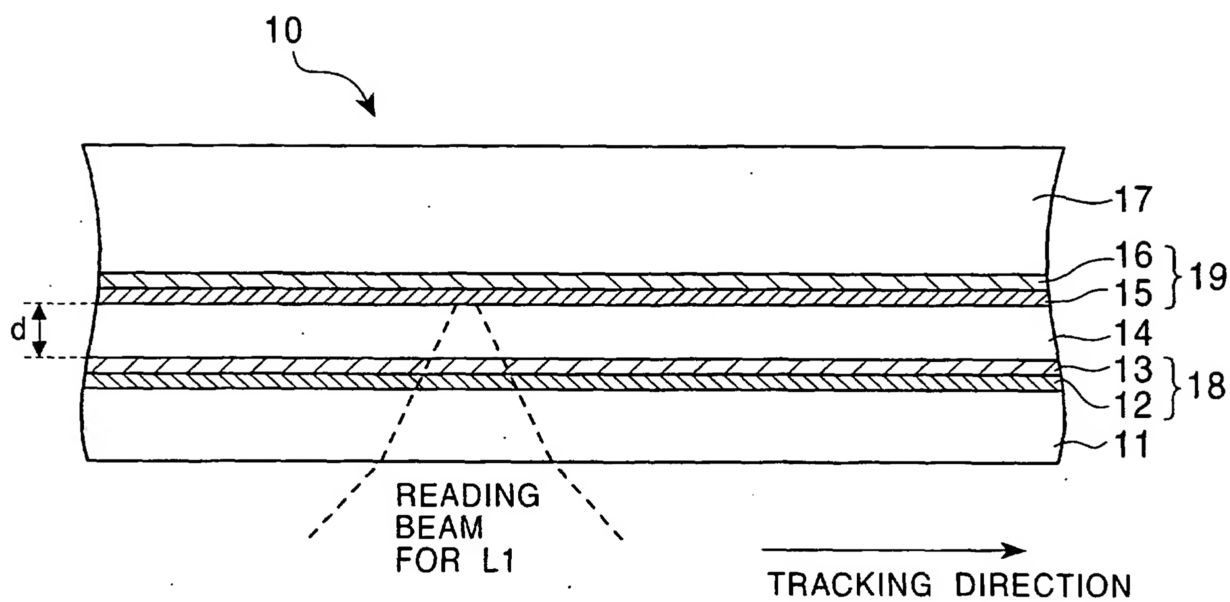
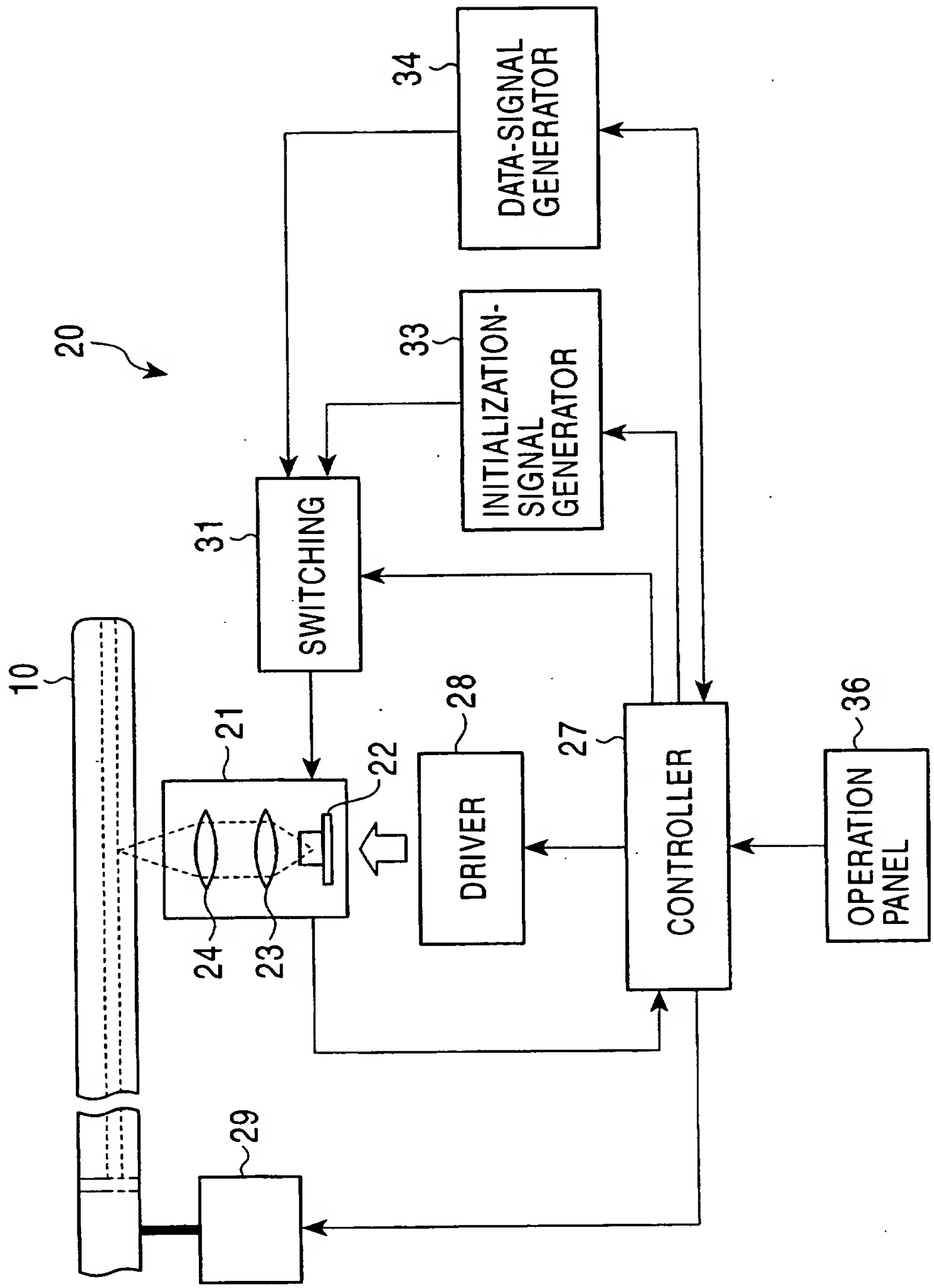

10
17
16
15
19
14
13
12
18
11
d
READING
BEAM
FOR L1
TRACKING DIRECTION

FIG. 2



20
10
21
22
23
24
28
DRIVER
27
CONTROLLER
36
OPERATION PANEL
31
SWITCHING
33
INITIALIZATION-SIGNAL GENERATOR
34
DATA-SIGNAL GENERATOR
29

FIG. 3

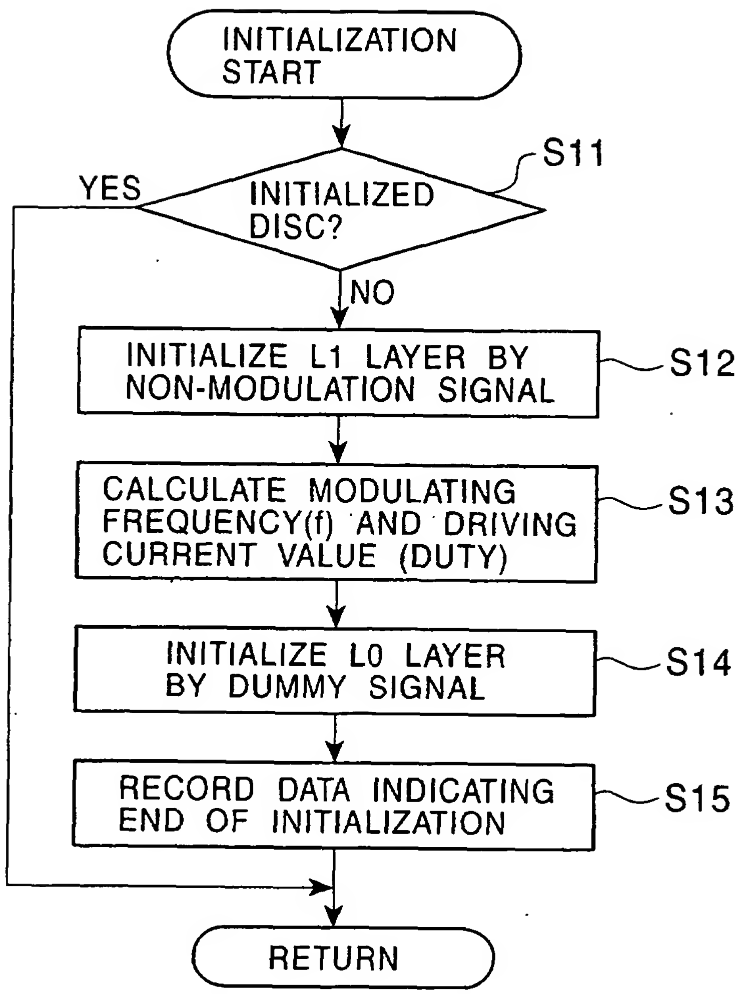

INITIALIZATION START
INITIALIZED DISC?
S11
YES
NO
INITIALIZE L1 LAYER BY NON-MODULATION SIGNAL
S12
CALCULATE MODULATING FREQUENCY(f) AND DRIVING CURRENT VALUE (DUTY)
S13
INITIALIZE L0 LAYER BY DUMMY SIGNAL
S14
RECORD DATA INDICATING END OF INITIALIZATION
S15
RETURN

FIG. 4